torrents, and causes the hills to become smothered in a mantle of their own débris, so that, as Stoliczka remarks, "it becomes almost an exception to observe a rock *in situ*," and the scenery becomes correspondingly tame.

The occasion of the reading of Dr. de Filippi's paper was memorable in more respects than one. Not only was an opportunity afforded, and happily utilised by the President of the Society, of expressing the cordiality of our relations with Italy, whether we are engaged together in peaceful exploration or in the more serious business of war, but also by the participation in the discussion of the father of Himalayan exploration in that region, Col. Godwin-Austen, and of another pioneer in Central Asian discovery, Sir F. Younghusband.

T. H. D. L.

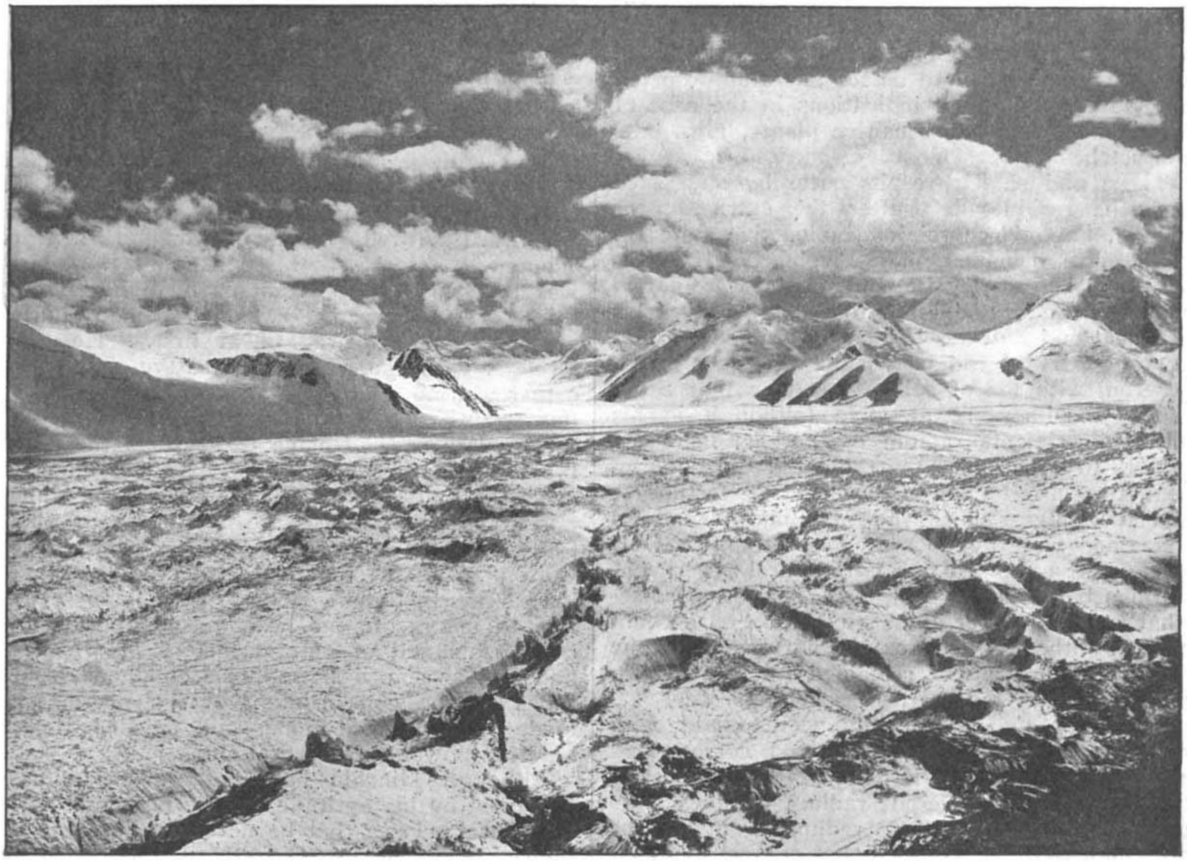

FIG. 2.—Middle portion of Remo Glacier, Northern Branch. From the *Geographical Journal*, August.

THE EFFECT OF RADIUM ON THE GROWTH OF PLANTS.

AMONG the many remarkable properties of radium it was perhaps natural to expect that it might have some definite effect on plants, and even, under suitable conditions, cause sufficient increase in the amount of growth to justify its use in horticulture and agriculture. The early observations of Dixon and Wigham[1] at Dublin, however, did not seem very promising: 100 seeds of cress (*Lepidium sativum*) were uniformly distributed over an even surface of moist quartz sand, and after germination had taken place a sealed tube containing 5 mgms. of radium bromide was set 1 cm. above the central seed. The seedlings grew up, but without any curvature indicating positive or negative "radiotropism," and the only noticeable effect was a slight depression of growth in those within 1 cm. radius of the tube. As stronger preparations of radium became available more definite retardations and inhibitions were observed: thus Gager, in an elaborate report,[2] noted a more or less complete inhibition in cell activities in younger and especially embryonic tissues, with few exceptions. The action of radium through the soil, however, was different; germination and growth were both accelerated, and the plants furthest away were stimulated most. Acqua[3] found that different plants, and even different organs of the same plant, were differently affected, the root system in general responding more markedly than the aerial parts,

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[1] Proc. Roy. Soc. Dublin, 1904, x., 178–192.
[2] Mem. New York Bot. Gard., 1908.
[3] *Ann. Bot.* (Rome), 1910, viii., 223–238.

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and in his experiments being arrested in their development.

The intensity of the radiation is important, and G. Fabre,[4] using *Linum catharticum* as test plant, was able to obtain increased development and germination of seedlings by working with emanations up to 1·5 microcuries per 2 litres of air, and to retard development by using emanations of 40 microcuries per litre of air. H. Molisch[5] obtained a like result: young plants of vetches, beans, sunflower, etc., were stimulated in growth by weak emanations, but checked or entirely stopped by stronger ones. He further claimed that the "rest period" could be broken by the radium emanation, and forced lilac into bloom in November by attaching pipettes containing small quantities of radium chloride to the terminal buds.[6] In his earlier experiments he, like Dixon and Wigham, failed to detect any radiotropism, but later on he found indications in the case of certain heliotropically sensitive plants, *e.g.*, oats and vetches.[7]

These and similar results naturally suggested that the residues left after the extraction of radium, but still containing radioactive material, might have definite manurial value, and it was not long before definite statements were forthcoming. Baker[8] claimed that increased yields of wheat and radishes had been obtained by mixing one part of radioactive material (2 mg. ra. per ton) with ten of soil. It is true that Stoklasa's[9] results were negative (although in his other experiments radium emanations increased growth to a marked extent), but this did not prevent the introduction of radioactive fertilisers, and the enterprising syndicates and companies concerned were by no means loth to push their wares. The staffs of the agricultural experiment stations being busy people and, moreover, somewhat sceptical about plant stimulation on account of some rather sad failures, did not generally take the matter up, and it remained for Mr. Martin Sutton to carry out the necessary tests.

Mr. Sutton's experiments were made with radishes, tomatoes, potatoes, onions, carrots, and marrows, some grown in pots, others in plots out of doors. Eight different radium residues were used, in addition to pure radium bromide; the dressings were so arranged that equivalent quantities of radium were given in each case (1/4000 mgm. radium bromide to 15 lbs. of soil in the pots; 2½ times this amount per square yard to the plots). Controls were set up, including a set treated with the other substances present in the residues, designed to ascertain whether those had any effect.

The results have just been issued by Mr. Sutton. Going carefully through them, one is forced to the conclusion that the radioactive materials have been ineffective. In no case is there any clear evidence of increased growth. Even the pure radium bromide seems to have done nothing. We are therefore left with an apparent discrepancy. The work of the physiologists, assuming it to be sound, certainly indicated that radium emanation is capable of stimulating certain cell activities. Mr. Sutton's results show that such stimulus, if it exists at all, does not affect the final growth of the plant. The discrepancy is not a new one, it is periodically confronting the agricultural investigator. Thus Dr. Winifred Brenchley, at Rothamsted, has failed to obtain increases in growth by supplying plants with inorganic poisons which have been supposed to stimulate certain cell functions in suitable dilutions. The result opens up the prospect of an interesting discussion, but it also shows the danger of arguing from a simple physiological observation to a complex phenomenon like the growth of a plant in soil.

E. J. RUSSELL.

PROF. E. A. MINCHIN, F.R.S.

IT is with profound regret that we announce the death, on September 30, at Selsey, of Prof. E. A. Minchin, F.R.S.

Edward Alfred Minchin, younger son of Charles N. Minchin by his wife Mary J. Lugard, was born in 1866. From his birth he suffered from a constitutional weakness, and indeed his life was despaired of at first. He grew stronger with age, yet the premature close of his career was no doubt due to the physical disabilities against which he had so bravely struggled to the very end. Unable to share in the rough life of the ordinary schoolboy, he was educated privately, and then for a short time at the United Service College, Westward Ho! When about fourteen years of age he went to the Bishop Cotton School at Bangalore after having joined his parents in India. Here he lived happy years, free to indulge to his heart's content that love of animals and of natural history of which he had already shown signs in his childhood, sometimes to the consternation of his nurse. He made valuable collections, and developed early his keen powers of observation.

Although Minchin had distinguished himself at school by his aptitude for the classics, it was to natural science that he devoted himself in his university career at Oxford. He obtained an exhibition at Keble College, and took his degree in 1890 with first-class honours in zoology. Shortly afterwards he was awarded the University Scholarship at Naples, and then the Radcliffe Travelling Fellowship. In 1893 he was elected Fellow of Merton College. He was thus enabled to travel abroad to pursue his researches in foreign marine zoological stations, and to work in the laboratories of Prof. Bütschli, in Heidelberg, and Prof. R. Hertwig, in Munich. For several years assistant to Sir Ray Lankester and demonstrator in comparative anatomy at Oxford, he afterwards became lecturer in biology at Guy's Hospital, but soon succeeded Weldon in the Jodrell chair of zoology at University College, London, in 1899.

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[4] *Compt. Rend. Soc. Biol.* (Paris), 1911, lxx., 187–188.

[5] *Umschau.* 1913. xvii., 95–98.

[6] *Oesterr. Gart. Ztg.*, 1912. vii., 197–202.

[7] *Sitzber. k. akad. wiss.* (Vienna), 1911, cxx., 305–318.

[8] *Journ. Roy. Soc. Arts*, 1913. lxii., 70–78.

[9] *Chem. Ztg.*, 1914, xxxviii., 841–844.

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